

Name _____

NASA/Tropical Rainfall Measuring Mission (TRMM)

Topic #5: Rain

Activity #3: Interpretation of Satellite Images

OBJECTIVE: To interpret images produced by the Precipitation Radar which is one of the instruments aboard the TRMM satellite

WHAT'S HAPPENING?

One of the exciting features of the TRMM satellite is that it carries the first rain radar ever launched in space. From its orbit of 215 miles (350 km) above the Earth, the **TRMM** instruments are able to make rainfall measurements over **remote** (distant) areas of land or water where data is difficult, if not impossible, to collect. The TRMM satellite is designed to make observations in the tropical regions between 35 N and 35 S latitudes where two thirds of the Earth's rainfall occurs. The Precipitation Radar sends a pulse of microwave energy into the atmosphere. If it strikes **precipitation** such as rain or snow, part of the energy is reflected back to the radar. These signals (called backscatter) are interpreted by scientists who display the data as colors on a satellite image. The radar is designed to provide a rainfall profile (side view) *up to a height of 15 miles (24 km)*. The profile measurements will give information on the amount of precipitation, its location in the cloud and the height at which the snow melts into rain.

MATERIALS: (per student)

Computer with Internet access to < [http:// trmm.gsfc.nasa.gov/](http://trmm.gsfc.nasa.gov/) >

NOTE: If students do not have on line access, make the following images into transparencies or color copies:

http://trmm.gsfc.nasa.gov/data/houston_inserts_md.html

<http://trmm.gsfc.nasa.gov/data/nc3insertpr-sm.html>

<http://www.intellicast.com/LocalWeather/World/United States/Precipitation/>

These images may also be accessed under the "Images" feature of this web site.

PROCEDURE & INTERPRETATION

1. Enter the address< [http:// trmm.gsfc.nasa.gov/](http://trmm.gsfc.nasa.gov/) >
2. Use the menu bar at the top of the screen to select "Image/Movie Archive"
3. Select "Latest Images"
4. Select "February 10, 1998 Interior intensity of major storm over Houston 980210 Large [181K]"
 - a. The bright colors and white streak indicate the area (200 km wide) covered by the path of satellite as it passes over the Earth. How would a stationary satellite that is positioned in over one area, improve scientists' understanding of a particular storm?

- b. Note the dark lines making an “X” in the brightly colored area. These lines mark a vertical cross section or side view of the storm. This view is shown in the box at the end of the white lines. *Does the red/high intensity rain reach to the top of the cloud?* _____ *Looking at the red and yellow rain at the left end, does the red /high intensity rain reach all the to the ground?* _____ *If the rain is warming as it falls, what might be happening to the rain (liquid) to cause it to “disappear”?* (HINT(water vapor) _____
5. Go back to “Latest Images” and select:
“March 10, 1998 – NC Storm PR 980310 – Small [274K]”
- c. This images shows three smaller storms in North Carolina (NC). In the left image, what is the height in km (kilometers) of the three large clouds?
_____ km _____ km _____ km
- d. In the lower right picture, describe the distribution (location) of the red/high intensity rain within the cloud? (HINT: horizontal/sideways OR vertical/up right) _____
- e. *Note the clear areas, beneath some of the clouds in all three cross sections. This area of no precipitation suggests the rain is not reaching the ground. If it warms as it falls, make an inference (suggested cause) as to what is happening to the rain.* _____
6. Go to the INTERNET address window and type in the following address:
<http://www.intellicast.com/LocalWeather/World/UnitedStates/Precipitation/>
This geostationary t(GOES) satellite is 25,000 miles above the Earth and therefore produces an image that includes more of the United States. The image shows the distribution and intensity of precipitation. It cannot show a cross section or side view of precipitation inside the storm.
- f. What color is used to indicate 3 to 4 inches of rain? _____
- g. What area of the map is showing the greatest intensity of rain?

- h. Why would this image not be helpful if a scientist wanted to study changes in precipitation within the cloud? _____

EXTENDING YOUR THINKING: The speed of a satellite’s orbit enables it to pull away from the Earth’s gravity. The closer an orbiting object is to the Earth, the faster it must travel to avoid being pulled toward the surface. The TRMM satellite is only 215 miles above the Earth and is in an orbit which results in periodic crossings of the same Earth point.. The geostationary (GOES) satellite is 25,000 mile high and orbits more slowly as it stays in position over the United States.

- i. *What would happen if the TRMM satellite moved slowly ?* _____
- j. *What could happen if the GOES satellite increased its speed?* _____
- j. *If the GOES satellite orbits in position over the USA, how long does it take to make one orbit of the Earth?* _____
- k. The Moon is 250,000 miles away. How much time is required for each orbit of the Earth? _____